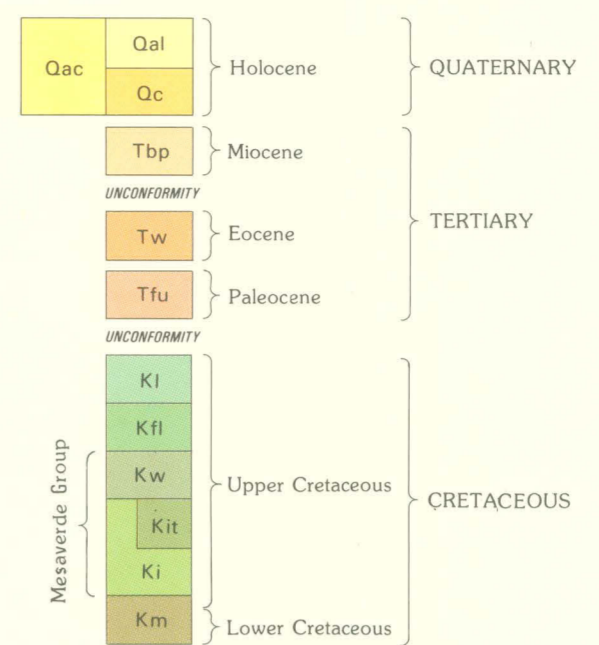


CORRELATION OF MAP UNITS



DESCRIPTION OF MAP UNITS

- Qal** Alluvium—Clay, silt, sand, and fine pebble to cobble gravel along present stream channels
- Qac** Colluvium—Poorly sorted deposits of clay, silt, and sand. Includes some slope wash
- Qac** Alluvium, colluvium, and slope wash, undivided—Unconsolidated clay, silt, sand, and gravel
- Tbp** Browns Park Formation (Miocene)—Light gray to chalky white, fine- to medium-grained tuffaceous quartz sandstone, generally crossbedded. Persistent basal conglomeratic sandstone consisting of subrounded to subangular pebbles of mafic and felsic igneous and metamorphic rocks, red and white quartzite, multicolored chert and milky quartz. 0-274 m (0-900 ft) thick
- Tw** Wasatch Formation (Eocene)—Variegated red to green mudstone and siltstone and dark-gray and light-brown crossbedded sandstone. Approximately 76 m (250 ft) exposed in quadrangle
- Tfu** Fort Union Formation (Paleocene)—Gray shale; brown carbonaceous shale; coal; gray, massive sandstone; and crossbedded sandstone. Basal conglomeratic sandstone, 0-12.2 m (0-40 ft) thick, consists of subrounded to rounded pebbles of felsic igneous and metamorphic rocks, red, white, and dark-gray quartzite, and multicolored chert, quartz, limestone, and petrified wood. Maximum thickness exposed within quadrangle is 305 m (1,000 ft)
- Kf** Lance Formation (Upper Cretaceous)—Light gray and yellowish-brown, massive, resistant sandstone interbedded with soft argillaceous sandstone, siltstone, gray shale, carbonaceous shale, and thin coal beds. Total thickness 152-366 m (500-1,200 ft); about 334 m (1,100 ft) exposed in western part of quadrangle
- Kw** Fox Hills Sandstone and Lewis Shale (Upper Cretaceous)—Fox Hills Sandstone: thick, light-gray, near-shore marine sandstone found at top of the mapped unit. Lewis Shale: dark-gray, calcareous marine shale with thin, calcareous sandstone beds. Total thickness 297-610 m (975-2,000 ft); about 270-305 m (900-1,000 ft) exposed in quadrangle
- Ki** Williams Fork Formation (Upper Cretaceous)—Brown, gray, and white, thick, massive, resistant, lenticular sandstone; gray and brown claystone; siltstone; mudstone; brown carbonaceous shale; and coal. Total thickness 485-533 m (1,600-1,750 ft); 229 m (750 ft) exposed in the quadrangle
- Kit** Iles Formation (Upper Cretaceous)—Gray, white, and brown, massive sandstone; some gray shale; siltstone; brown carbonaceous shale; and thin coal beds. Total thickness 366-427 m (1,200-1,400 ft). Shown in cross section only
- Km** Trout Creek Sandstone Member—White, massive sandstone at top of Iles Formation. Total thickness 24-30 m (80-100 ft). Shown in cross section only
- Km** Mancos Shale (Upper and Lower Cretaceous)—Dark-gray shale and lenticular sandstone in upper and lower parts. Includes Frontier Sandstone Member (Upper Cretaceous) and Mowry Shale Member (Lower Cretaceous). Total thickness about 1,676 m (5,500 ft) from drill-hole data. Shown in cross section only

- Coal bed**—Approximately located; dashed where inferred. Thickness, in meters, measured at triangle. Number in circle refers to location of measured coal bed section. Letter symbol, *cz*, indicates carbonaceous shale zone containing very little coal; mapped locally for structural control
- Clinker**—Rocks baked and fused by the in-place burning of an underlying coal bed. Outcrop trace of the coal bed, prior to burning, shown by chevrons. Limit of clinker shown by dashed line
- Contact**—Approximately located and inferred
- D** **U** **Fault**—Approximately located; dashed where inferred; dotted where concealed. D, downthrown side; U, upthrown side
- Concealed anticline**—Dotted where concealed
- Syncline**—Approximately located; dashed where inferred; dotted where concealed
- Strike and dip of beds**
- 6000** **Structure contours**—Drawn on base of Fort Union Formation, in feet, using surface and drill-hole data. Short dashed where projected over land surface. Contour interval 200 ft (61 m)
- Adit**—Inaccessible; **caved**
- Prospect pit**—Coal
- Prospect pit**—Uranium
- Gravel pit**
- U.S. Geological Survey drill hole**—Showing number
- Dry hole**—Showing name of operator, lease name, and total depth, in meters
- Oil or gas well**—Showing name of operator, lease name, and total depth, in meters

ECONOMIC GEOLOGY

The Lay SE quadrangle was mapped as part of the U.S. Geological Survey's program of classifying and evaluating lands in the public domain. Resources of economic interest within the quadrangle include subbituminous and bituminous coal, oil and gas, uranium, and sand and gravel.

COAL

Coal beds greater than 1.2 m (4 ft) thick are found within three formations in the quadrangle: the Williams Fork, the Lance, and the Fort Union Formations.

The Williams Fork Formation coal beds range in thickness from less than 0.3 m (1 ft) to 4.3 m (14 ft). Several coal beds within the Williams Fork were described by Fenneman and Gale (1906, p. 63) in sec. 31, T. 7 N., R. 93 W., in the southwestern part of the quadrangle. The Sweeney tunnel exposed a 4.3-m-thick (14-ft) coal bed (measured coal section 47). A U.S. Geological Survey exploration hole (LSE-10, sec. 32, T. 7 N., R. 93 W.) was drilled in 1975 and encountered several coal beds in the Williams Fork Formation (Muller, 1976).

The Lance Formation contains little coal in the Lay SE quadrangle. The coal beds are lenticular and of poorer quality than those found in the Williams Fork Formation. A 1.5-m-thick (5-ft) coal bed is exposed at an old homestead mine (measured coal section 44) in sec. 3, T. 7 N., R. 93 W. This was the only Lance coal bed found with a thickness greater than 1.2 m (4 ft).

The Fort Union coal beds occur throughout the formation and range in thickness from less than 0.3 m (1 ft) to 7.6 m (25 ft). Locally, they contain shaly partings and pinch out or grade laterally into carbonaceous shale. Three coal zones were mapped within the Fort Union Formation. The lower coal zone, approximately 76.5 m (250 ft) above the basal conglomerate of the Fort Union, contains several beds greater than 0.9 m (2.5 ft) in thickness; the zone is represented by measured coal section 9 in sec. 32, T. 8 N., R. 93 W. The middle zone, approximately 139 m (455 ft) above the base, contains one thick coal bed named the Emerson coal bed because of its excellent exposures along the ridges within the old Emerson ranch. The Emerson coal bed attains a maximum thickness of 7.6 m (25 ft) in sec. 31, T. 8 N., R. 93 W. (measured coal section 1). The upper coal zone, approximately 200 m (660 ft) above the base, contains the Bleivins coal bed, which is named for the Bleivins mine (Gale, 1907) near measured coal section 13. The Bleivins coal bed has a thickness of 4.1 m (13.5 ft) and can be traced for several kilometers along the outcrop.

Coal in the quadrangle ranges in rank from subbituminous to bituminous. Two analyses of coal from the Williams Fork Formation indicate an average heat value of 11,355 Btu/lb on an air-dried basis, an ash content of 6.43 percent, and a sulfur content of 1.09 percent. Coal in the Fort Union Formation is of lower rank and quality than Williams Fork coal. The results of coal analyses from the Bleivins mine (NE 1/4 NW 1/4 sec. 28, T. 8 N., R. 93 W.) showed a heat value of 10,290 Btu/lb on an air-dried basis, an ash content of 7.59 percent, and a sulfur content of 1.21 percent (Gale, 1907). Coal quality has been determined from four core holes, which were drilled through the middle and upper coal zones of the Fort Union Formation (Brownfield, 1981). The results of the coal analyses were averaged to obtain a heat value of 10,300 Btu/lb, a moisture content of 13 percent, an ash content of 8.0 percent, and a sulfur content of 0.49 percent.

Currently, there is no active coal mining within the quadrangle; however, several abandoned mines and prospects are present in the Williams Fork, Lance, and Fort Union Formations. Fenneman and Gale (1906, p. 63) described several coal prospects and mines in sec. 31, T. 7 N., R. 93 W., within the Williams Fork. Numerous abandoned mines and coal prospects were found throughout the three coal zones of the Fort Union. The Bleivins wagon mine supplied coal for a placer dredge and steam-driven pumping station 22 km (13.5 mi) to the north at Great Divide (Gale, 1910).

OIL AND GAS

Within the quadrangle, oil and gas are produced north of Big Gulch. The producing zones are sandstone beds in the Iles and Williams Fork Formations, the upper part of the Mancos Shale, and sandstone beds in the Frontier Sandstone Member of the Mancos Shale. A westward extension of the Williams Fork anticline (Hancock, 1925) forms a structural trap for the gas and oil being produced in the Big Gulch field (secs. 15, 16, 21, 22, T. 7 N., R. 93 W.).

URANIUM

Numerous uranium prospect pits were found while mapping the Browns Park Formation (secs. 2 and 3, T. 7 N., R. 93 W.). Although no mines are present within the Lay SE quadrangle, 14.3 km (9 mi) to the west the Union Carbide Corporation has operated a uranium mine. Within the quadrangle, the Browns Park Formation may contain minable ore bodies near the axis of the Lay syncline (Bergin, 1959), which is a depositional feature in the Browns Park Formation. Ground-water movement towards the axis of this depositional feature may have transported uranium-bearing solutions and formed roll-type uranium deposits similar to the roll-type deposits found in the Union Carbide mines to the west.

NONMETALLIC MINERALS

The Quaternary deposits in the area supply sand and gravel for road building. Particularly valuable for road building are the alluvial gravels found along Big Gulch. Clinker found above burned coal beds has been used for road metal in the region, and, within the quadrangle, the Fort Union Formation contains clinker which could be used for road metal.

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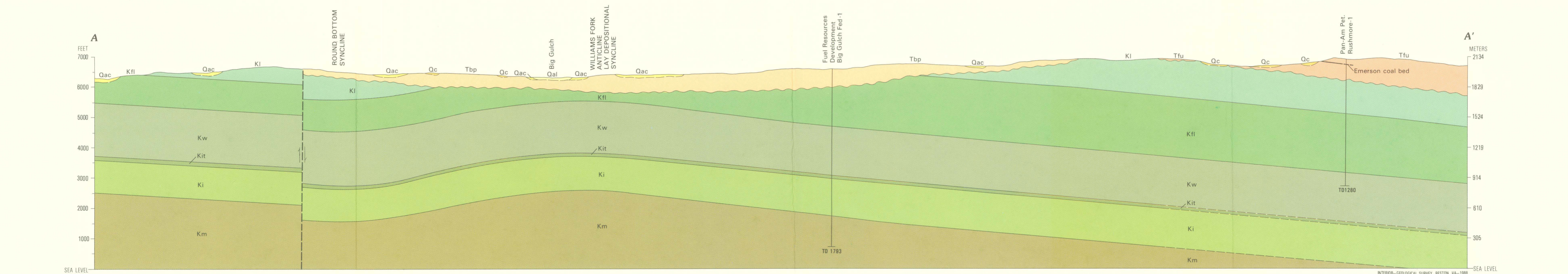
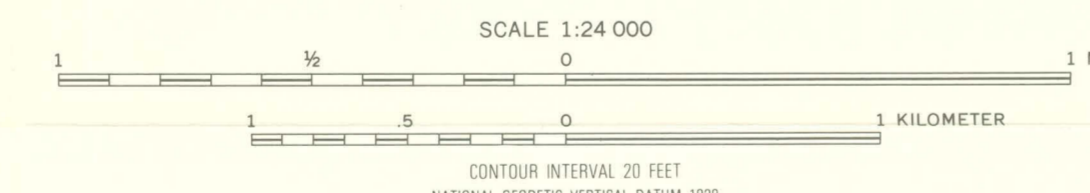
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CONVERSION FACTORS FOR METRIC EQUIVALENTS

To convert ENGLISH UNIT	Multiply by	To obtain METRIC UNIT
Foot	1.609	Kilometer
Foot	0.3048	Meter

Base from U.S. Geological Survey, 1989
Photorevised 1973
10,000-foot grid based on Colorado coordinate system,
epoch zero
1000-meter Universal Transverse Mercator grid ticks,
zone 13, shown in blue



GEOLOGIC MAP AND COAL SECTIONS OF THE LAY SE QUADRANGLE, MOFFAT COUNTY, COLORADO

By
Michael E. Brownfield and Kevin Anderson
1988